

## **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

### **Listing of Claims:**

1           1. (Currently amended) A method for characterizing a document with  
2   respect to clusters of conceptually related words, comprising:  
3           receiving the document, wherein the document contains a set of words;  
4           selecting candidate clusters of conceptually related words that are related  
5   to the set of words;  
6           wherein the candidate clusters are selected using a model that explains  
7   how sets of words are generated from clusters of conceptually related words,  
8   wherein the conceptually related words are words that relate to a single idea; and  
9           constructing a set of components to characterize the document, wherein  
10   the set of components includes components for candidate clusters, wherein each  
11   component indicates a degree to which a corresponding candidate cluster is  
12   related to the set of words,  
13   wherein the set of components is subsequently used to generate a response  
14   to a query from a user.

1           2. (Original) The method of claim 1, wherein the model is a probabilistic  
2   model, which contains nodes representing random variables for words and for  
3   clusters of conceptually related words.

1           3. (Original) The method of claim 2, wherein each component in the set of  
2 components indicates a degree to which a corresponding candidate cluster is  
3 active in generating the set of words.

1           4. (Original) The method of claim 3,  
2 wherein nodes in the probabilistic model are coupled together by weighted  
3 links; and  
4 wherein if a cluster node in the probabilistic model fires, a weighted link  
5 from the cluster node to another node can cause the other node to fire.

1           5. (Original) The method of claim 4, wherein if a node has multiple parent  
2 nodes that are active, the probability that the node does not fire is the product of  
3 the probabilities that links from the active parent nodes do not fire.

1           6. (Original) The method of claim 2, wherein the probabilistic model  
2 includes a universal node that is always active and that has weighted links to all  
3 cluster nodes.

1           7. (Original) The method of claim 4, wherein selecting the candidate  
2 clusters involves:  
3           constructing an evidence tree by starting with terminal nodes associated  
4 with the set of words in the document, and following links in the reverse direction  
5 to parent cluster nodes;  
6           using the evidence tree to estimate a likelihood that each parent cluster  
7 node was active in generating the set of words; and  
8           selecting a parent cluster node to be a candidate cluster node based on its  
9 estimated likelihood.

1           8. (Original) The method of claim 7, wherein estimating the likelihood that  
2 a given parent node is active in generating the set of words may involve  
3 considering:  
4           the unconditional probability that the given parent node is active;  
5           conditional probabilities that the given parent node is active assuming  
6 parent nodes of the given parent node are active; and  
7           conditional probabilities that the given parent node is active assuming  
8 child nodes of the given parent node are active.

1           9. (Original) The method of claim 8, wherein considering the conditional  
2 probabilities involves considering weights on links between nodes.

1           10. (Original) The method of claim 7 wherein estimating the likelihood  
2 that a given parent node is active in generating the set of words involves marking  
3 terminal nodes during the estimation process to ensure that terminal nodes are not  
4 factored into the estimation more than once.

1           11. (Original) The method of claim 7, wherein constructing the evidence  
2 tree involves pruning unlikely nodes from the evidence tree.

1           12. (Original) The method of claim 3, wherein during construction of the  
2 set of components, the degree to which a candidate cluster is active in generating  
3 the set of words is determined by calculating a probability that a candidate cluster  
4 is active in generating the set of words.

1           13. (Original) The method of claim 3, wherein during construction of the  
2 set of components, the degree to which a candidate cluster is active in generating  
3 the set of words is determined by multiplying a probability that a candidate cluster

4 is active in generating the set of words by an activation for the candidate cluster,  
5 wherein the activation indicates how many links from the candidate cluster to  
6 other nodes are likely to fire.

1 14. (Original) The method of claim 1, wherein constructing the set of  
2 components involves normalizing the set of components.

1 15. (Original) The method of claim 3, wherein constructing the set of  
2 components involves approximating a probability that a given candidate cluster is  
3 active over states of the probabilistic model that could have generated the set of  
4 words.

1 16. (Original) The method of claim 15, wherein approximating the  
2 probability involves:  
3 selecting states for the probabilistic model that are likely to have generated  
4 the set of words in the document; and  
5 considering only selected states while calculating the probability that the  
6 given candidate cluster is active.

1 17. (Original) The method of claim 16, wherein selecting a state that is  
2 likely to have generated the set of words involves:  
3 randomly selecting a starting state for the probabilistic model; and  
4 performing hill-climbing operations beginning at the starting state to reach  
5 a state that is likely to have generated the set of words.

1 18. (Original) The method of claim 17, wherein performing the hill-  
2 climbing operations involves periodically changing states of individual candidate  
3 clusters without regards to an objective function for the hill-climbing operations

4 to explore states of the probabilistic model that are otherwise unreachable through  
5 hill-climbing operations.

1 19. (Original) The method of claim 18, wherein changing a state of an  
2 individual candidate cluster involves temporarily fixing the changed state to  
3 produce a local optimum for the objective function, which includes the changed  
4 state.

1 20. (Original) The method of claim 1, wherein the document can include:  
2 a web page; or  
3 a set of terms from a query.

1 21. (Currently amended) A computer-readable storage medium storing  
2 instructions that when executed by a computer cause the computer to perform a  
3 method for characterizing a document with respect to clusters of conceptually  
4 related words, wherein the computer-readable storage medium is one of a disk  
5 drive, a magnetic tape, a CDs (compact discs), and a DVDs (digital versatile disc  
6 or digital video disc). the method comprising:  
7 receiving the document, wherein the document contains a set of words;  
8 selecting candidate clusters of conceptually related words that are related  
9 to the set of words, wherein the conceptually related words are words that relate to  
10 a single idea;  
11 wherein the candidate clusters are selected using a model that explains  
12 how sets of words are generated from clusters of conceptually related words; and  
13 constructing a set of components to characterize the document, wherein  
14 the set of components includes components for candidate clusters, wherein each  
15 component indicates a degree to which a corresponding candidate cluster is  
16 related to the set of words,

17        wherein the set of components is subsequently used to generate a response  
18        to a query from a user.

1            22. (Original) The computer-readable storage medium of claim 21,  
2        wherein the model is a probabilistic model, which contains nodes representing  
3        random variables for words and for clusters of conceptually related words.

1            23. (Original) The computer-readable storage medium of claim 22,  
2        wherein each component in the set of components indicates a degree to which a  
3        corresponding candidate cluster is active in generating the set of words.

1            24. (Original) The computer-readable storage medium of claim 23,  
2        wherein nodes in the probabilistic model are coupled together by weighted  
3        links; and  
4            wherein if a cluster node in the probabilistic model fires, a weighted link  
5        from the cluster node to another node can cause the other node to fire.

1            25. (Original) The computer-readable storage medium of claim 24,  
2        wherein if a node has multiple parent nodes that are active, the probability that the  
3        node does not fire is the product of the probabilities that links from the active  
4        parent nodes do not fire.

1            26. (Original) The computer-readable storage medium of claim 22,  
2        wherein the probabilistic model includes a universal node that is always active  
3        and that has weighted links to all cluster nodes.

1            27. (Original) The computer-readable storage medium of claim 24,  
2        wherein selecting the candidate clusters involves:

3           constructing an evidence tree by starting with terminal nodes associated  
4   with the set of words in the document, and following links in the reverse direction  
5   to parent cluster nodes;  
6           using the evidence tree to estimate a likelihood that each parent cluster  
7   node was active in generating the set of words; and  
8           selecting a parent cluster node to be a candidate cluster node based on its  
9   estimated likelihood.

1           28. (Original) The computer-readable storage medium of claim 27,  
2   wherein estimating the likelihood that a given parent node is active in generating  
3   the set of words may involve considering:  
4           the unconditional probability that the given parent node is active;  
5           conditional probabilities that the given parent node is active assuming  
6   parent nodes of the given parent node are active; and  
7           conditional probabilities that the given parent node is active assuming  
8   child nodes of the given parent node are active.

1           29. (Original) The computer-readable storage medium of claim 28,  
2   wherein considering the conditional probabilities involves considering weights on  
3   links between nodes.

1           30. (Original) The computer-readable storage medium of claim 27,  
2   wherein estimating the likelihood that a given parent node is active involves  
3   marking terminal nodes during the estimation process to ensure that terminal  
4   nodes are not factored into the estimation more than once.

1           31. (Original) The computer-readable storage medium of claim 27,  
2 wherein constructing the evidence tree involves pruning unlikely nodes from the  
3 evidence tree.

1           32. (Original) The computer-readable storage medium of claim 23,  
2 wherein during construction of the set of components, the degree to which a  
3 candidate cluster is active in generating the set of words is determined by  
4 calculating a probability that a candidate cluster is active in generating the set of  
5 words.

1           33. (Original) The computer-readable storage medium of claim 23,  
2 wherein during construction of the set of components, the degree to which a  
3 candidate cluster is active in generating the set of words is determined by  
4 multiplying a probability that a candidate cluster is active in generating the set of  
5 words by an activation for the candidate cluster, wherein the activation indicates  
6 how many links from the candidate cluster to other nodes are likely to fire.

1           34. (Original) The computer-readable storage medium of claim 21,  
2 wherein constructing the set of components involves normalizing the set of  
3 components.

1           35. (Original) The computer-readable storage medium of claim 23,  
2 wherein constructing the set of components involves approximating a probability  
3 that a given candidate cluster is active over states of the probabilistic model that  
4 could have generated the set of words.

1           36. (Original) The computer-readable storage medium of claim 35,  
2 wherein approximating the probability involves:



3           selecting states for the probabilistic model that are likely to have generated  
4 the set of words in the document; and  
5           considering only selected states while calculating the probability that the  
6 given candidate cluster is active.

1           37. (Original) The computer-readable storage medium of claim 36,  
2 wherein selecting a state that is likely to have generated the set of words involves:  
3           randomly selecting a starting state for the probabilistic model; and  
4           performing hill-climbing operations beginning at the starting state to reach  
5 a state that is likely to have generated the set of words.

1           38. (Original) The computer-readable storage medium of claim 37,  
2 wherein performing the hill-climbing operations involves periodically changing  
3 states of individual candidate clusters without regards to an objective function for  
4 the hill-climbing operations to explore states of the probabilistic model that are  
5 otherwise unreachable through hill-climbing operations.

1           39. (Original) The computer-readable storage medium of claim 38,  
2 wherein changing a state of an individual candidate cluster involves temporarily  
3 fixing the changed state to produce a local optimum for the objective function,  
4 which includes the changed state.

1           40. (Original) The computer-readable storage medium of claim 21,  
2 wherein the document can include:  
3           a web page; or  
4           a set of terms from a query.

1           41. (Currently amended) An apparatus for characterizing a document with  
2   respect to clusters of conceptually related words, comprising:  
3           a receiving mechanism, configured to receive the document, wherein the  
4   document contains a set of words;  
5           a selection mechanism configured to select candidate clusters of  
6   conceptually related words that are related to the set of words;  
7           wherein the candidate clusters are selected using a model that explains  
8   how sets of words are generated from clusters of conceptually related words,  
9   wherein the conceptually related words are words that relate to a single idea; and  
10          a component construction mechanism configured to construct a set of  
11   components to characterize the document, wherein the set of components includes  
12   components for candidate clusters, wherein each component indicates a degree to  
13   which a corresponding candidate cluster is related to the set of words,  
14          wherein the set of components is subsequently used by a generation  
15   mechanism to generate a response to a query from a user.

1           42. (Original) The apparatus of claim 41, wherein the model is a  
2   probabilistic model, which contains nodes representing random variables for  
3   words and for clusters of conceptually related words.

1           43. (Original) The apparatus of claim 42, wherein each component in the  
2   set of components indicates a degree to which a corresponding candidate cluster is  
3   active in generating the set of words.

1           44. (Original) The apparatus of claim 43,  
2   wherein nodes in the probabilistic model are coupled together by weighted  
3   links; and

4            wherein if a cluster node in the probabilistic model fires, a weighted link  
5            from the cluster node to another node can cause the other node to fire.

1            45. (Original) The apparatus of claim 44, wherein if a node has multiple  
2            parent nodes that are active, the probability that the node does not fire is the  
3            product of the probabilities that links from the active parent nodes do not fire.

1            46. (Original) The apparatus of claim 43, wherein the probabilistic model  
2            includes a universal node that is always active and that has weighted links to all  
3            cluster nodes.

1            47. (Original) The apparatus of claim 44, wherein the selection mechanism  
2            is configured to:

3                   construct an evidence tree by starting with terminal nodes associated with  
4                   the set of words in the document, and following links in the reverse direction to  
5                   parent cluster nodes;

6                   use the evidence tree to estimate a likelihood that each parent cluster node  
7                   was active in generating the set of words; and to

8                   select a parent cluster node to be a candidate cluster node based on its  
9                   estimated likelihood.

1            48. (Original) The apparatus of claim 47, wherein while estimating the  
2            likelihood that a given parent node is active in generating the set of words, the  
3            selection mechanism is configured to consider at least one of the following:

4                   the unconditional probability that the given parent node is active;

5                   conditional probabilities that the given parent node is active assuming  
6                   parent nodes of the given parent node are active; and

7 conditional probabilities that the given parent node is active assuming  
8 child nodes of the given parent node are active.

1 49. (Original) The apparatus of claim 48, wherein while considering the  
2 conditional probabilities, the selection mechanism is configured to consider  
3 weights on links between nodes.

1 50. (Original) The apparatus of claim 47, wherein while estimating the  
2 likelihood that a given parent node is active in generating the set of words, the  
3 selection mechanism is configured to mark terminal nodes during the estimation  
4 process to ensure that terminal nodes are not factored into the estimation more  
5 than once.

1 51. (Original) The apparatus of claim 47, wherein while constructing the  
2 evidence tree, the selection mechanism is configured to prune unlikely nodes from  
3 the evidence tree.

1 52. (Original) The apparatus of claim 43, wherein while constructing a  
2 given component in the set of components, the component construction  
3 mechanism is configured to determine the degree to which a candidate cluster is  
4 active in generating the set of words by calculating a probability that a candidate  
5 cluster is active in generating the set of words.

1 53. (Original) The apparatus of claim 43, wherein while constructing a  
2 given component in the set of components, the component construction  
3 mechanism is configured to determine the degree to which a candidate cluster is  
4 active in generating the set of words by multiplying a probability that a candidate  
5 cluster is active in generating the set of words by an activation for the candidate

6 cluster, wherein the activation indicates how many links from the candidate  
7 cluster to other nodes are likely to fire.

1 54. (Original) The apparatus of claim 41, wherein the component  
2 construction mechanism is configured to normalize the set of components.

1 55. (Original) The apparatus of claim 43, wherein the component  
2 construction mechanism is configured to approximate a probability that a given  
3 candidate cluster is active over states of the probabilistic model that could have  
4 generated the set of words.

1 56. (Original) The apparatus of claim 55, wherein while approximating the  
2 probability, the component construction mechanism is configured to:  
3 select states for the probabilistic model that are likely to have generated  
4 the set of words in the document; and to  
5 consider only selected states while calculating the probability that the  
6 given candidate cluster is active.

1 57. (Original) The apparatus of claim 56, wherein while selecting a state  
2 that is likely to have generated the set of words, the component construction  
3 mechanism is configured to:  
4 randomly select a starting state for the probabilistic model; and to  
5 perform hill-climbing operations beginning at the starting state to reach a  
6 state that is likely to have generated the set of words.

1 | 58. (Currently amended) The apparatus of claim 57-~~claim 58~~, wherein  
2 while performing the hill-climbing operations, the component construction  
3 mechanism is configured to periodically change states of individual candidate

4 clusters without regards to an objective function for the hill-climbing operations  
5 to explore states of the probabilistic model that are otherwise unreachable through  
6 hill-climbing operations.

1 59. (Original) The apparatus of claim 58, wherein while changing a state  
2 of an individual candidate cluster, the component construction mechanism is  
3 configured to temporarily fix the changed state to produce a local optimum for the  
4 objective function, which includes the changed state.

1 60. (Original) The apparatus of claim 41, wherein the document can  
2 include:  
3 a web page; or  
4 a set of terms from a query.

1 61. (Currently amended) A computer-readable storage medium containing  
2 a data structure that facilitates characterizing a document with respect to clusters  
3 of conceptually related words, wherein the computer-readable storage medium is  
4 one of a disk drive, a magnetic tape, a CDs (compact discs), and a DVDs (digital  
5 versatile disc or digital video disc), the data structure comprising:  
6 a probabilistic model that contains nodes representing random variables  
7 for words and for clusters of conceptually related words, wherein the conceptually  
8 related words are words that relate to a single idea;  
9 wherein nodes in the probabilistic model are coupled together by weighted  
10 links;  
11 wherein if a cluster node in the probabilistic model fires, a weighted link  
12 from the cluster node to another node can cause the other node to fire; and  
13 wherein the other code can be associated with a word or a cluster.

1           62. (Original) The computer-readable storage medium of claim 61,  
2   wherein the probabilistic model includes a universal node that is always active  
3   and that has weighted links to all cluster nodes.